

UNITED STATES
DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
Metal and Nonmetal Mine Safety and Health

REPORT OF INVESTIGATION

Surface Nonmetal Mine
(Sand and Gravel)

Fatal Powered Haulage Accident
July 18, 2007

Pit #40 Waterloo
Lyman-Richey Sand & Gravel Company
Waterloo, Douglas County, Nebraska
Mine I.D. No. 25-00245

Investigators

Shane P. Julien
Mine Safety and Health Inspector

Christopher J. Kelly
Civil Engineer

Originating Office
Mine Safety and Health Administration
Rocky Mountain District
Denver Federal Center 6th & Kipling
2nd Street, Bldg 25, E-16
Denver, Colorado 80225
Richard Laufenberg, District Manager

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The loader turned nearly 180 degrees with the front facing the water, prior to the bank failure



Loader traveled in reverse along this route

OVERVIEW

On July 18, 2007, Kent L. Raikes, loader operator, age 42, was fatally injured when the front-end loader he was operating fell into a dredge pond. Raikes had been using the loader to set an 80-foot section of dredge pipe into the water when the shoreline sloughed into the dredge pond.

The accident occurred because the procedures failed to adequately address the risks associated with work performed near the dredge pond. The mining methods used did not ensure that slope stability could be maintained in places where persons worked or traveled near the dredge pond. The waste sand shear strength of the dredge pond was incapable of maintaining a stable slope with the added dynamic of the front-end loader and the dredge pipe.

GENERAL INFORMATION

Pit #40 Waterloo, a sand and gravel operation, owned and operated by Lyman-Richey Sand & Gravel Company, was located on U.S. Hwy 275, four miles east of Waterloo, Douglas County, Nebraska. The principal operating official was Doug L. Harrison, general manager.

The mine normally operated one 10-hour shift, five days per week. Total employment was nine persons.

Sand and gravel was mined from a pond with a suction dredge attached to a 3,800-foot floating discharge pipeline. Raw material was pumped from the dredge to the plant where it was crushed, sized, and stockpiled. Finished products were sold for use as a construction aggregate.

The last regular inspection of this operation was completed on November 8, 2006.

DESCRIPTION OF ACCIDENT

On the day of the accident, Kent L. Raikes (victim) reported to work at 7:00 a.m., his normal starting time. Doug L. Harrison, general manager, assigned Raikes, Steve Boothe, loader operator, and Donny Harrington, dredge operator, to perform their normal duties as assigned on the dredge. During the shift, they determined that an additional section of discharge pipe needed to be added to the system.

Raikes and Boothe drove the loaders to the lay-down area where the section of pipe fitted with floatation pontoons was located. About 12:30 p.m., they positioned the front-end loaders on opposite ends of the 80-foot section of pipe. Harrington helped them attach a chain to each flange end of pipe and then connected a hook to each loader bucket. Both front-end loaders then lifted the pipe and transported it from the lay-down area to the water's edge. Raikes backed his loader while Boothe drove the other one forward. This work progressed without incident.

About 12:50 p.m., Raikes, Boothe, and Harrington approached an area along the shoreline where waste sand had been deposited about 8 or 9 years ago forming a peninsula that protruded out into the pond. Raikes backed his loader out toward the water and onto the deposited sand peninsula. He positioned the loader and turned to the right facing the water. The dredge pipe was disconnected from Raikes' loader while Boothe's loader, facing the water's edge, was still chained to the pipe. The dredge pipe was positioned with the first two floatation pontoons in the water, off the end of the peninsula and the last two still on shore chained to Boothe's loader. Boothe placed the loader bucket on the ground preparing to disconnect the dredge pipe.

Boothe observed the shoreline beginning to fail where Raikes' loader was parked. He noticed the shoreline sinking into the pond and radioed Raikes to get out but he did not respond. As Harrington was moving the work boat into position, he noticed the

pipe was moving and saw Raikes' loader sinking into the pond. Boothe dismounted his loader and yelled to Harrington to come to shore and get him so they could attempt to rescue Raikes.

Booth and Harrington reached the submerged loader and dove several times but were unable to open the door of the cab. Harrington broke the rear window on the cab with a hammer. He opened the cab door and recovered Raikes. Harrington and Boothe got Raikes into the work boat and started cardiopulmonary resuscitation (CPR).

When they reached the shore, Harrison called for emergency medical assistance. Emergency medical personnel arrived and air-lifted the victim to a hospital where he was pronounced dead. The cause of death was attributed to drowning.

INVESTIGATION OF THE ACCIDENT

The Mine Safety and Health Administration was notified of the accident at 1:05 p.m., on July 18, 2007, by a telephone call from Stanley E. Benke, Jr., corporate safety manager, to Michael Dennehy, supervisory special investigator. An investigation was started the same day.

An order was issued under the provisions of Section 103(k) of the Mine Act to ensure the safety of the miners. MSHA's accident investigators traveled to the mine, made a physical inspection of the accident scene, interviewed employees, and reviewed conditions and work procedures relevant to the accident. MSHA conducted the investigation with the assistance of mine management and employees.

DISCUSSION

Location of the Accident

The accident occurred on the northern shore of the dredge pond on hydraulically deposited dredge tailings. The dredge tailings bank was part of a sand dike that separated the dredge pond from a smaller water storage pond. The dredge pond was on the south side of the dike and the water storage pond was on the north side. The dike was approximately 80 feet wide in the vicinity of the failure. Neither pond was provided with a liner. Water surface elevations were maintained near the top of the dike.

The ground water table appeared to be consistently shallow throughout the dike because it was narrow and sandy and the water surface elevations were high relative to the top of the dike. This condition created a correspondingly shallow zone of saturated sand in close proximity to the ground surface.

Location of the Loader

Tire tracks on the perimeter of the largest failure scarp suggested that the loader involved in the accident was approximately 50 to 60 feet away from the pre-failure shoreline at the time of failure. Based on a description of the maneuvers made by the loader and the orientation of the tire tracks, it appeared the loader was operating generally perpendicular to the pre-failure shoreline and was facing southeast toward the dredge pond. At the perimeter of the failure scarp, the loader was operating approximately four feet above the ground water table and the corresponding zone of saturated sand.

The submerged loader was located approximately 100 feet from the post-failure shoreline. The depth of the pond at this location was approximately 17 feet. The loader was found in an upright position, facing to the southeast and away from the post-failure shoreline. The roof of the loader cab was approximately 4 feet below the water surface.

Cause of the Failure

The failed area was delineated by three arc-shaped failure surfaces. Each surface was characterized by a distinct failure scarp. The largest scarp was located in the area where the victim's loader had been operating. The two smaller scarps were located immediately to the west of the largest scarp. The largest scarp represented the initial stage of the failure. The two smaller scarps represented subsequent failure stages, occurring in conjunction with the loss of lateral support caused by the initial failure stage.

The length of the failed area along the shoreline was approximately 190 feet. The estimated width of the failed area from the pre-failure to post-failure shoreline was approximately 90 feet. The estimated volume of failed bank material above the waterline was approximately 1,200 cubic yards.

Hydraulically placed sand was not compacted and was characterized by a high void ratio and correspondingly low bulk density. The loose condition of this type of material made it susceptible to a high degree of consolidation under applied loads. When consolidation of this material occurred under saturated conditions, excess water pressure developed in the void spaces between the individual sand particles. The excess pressure forced the sand particles apart and negated the shear strength of the sand until the excess pressure was able to dissipate. The loss of shear strength often results in a bank failure, particularly under a sustained load.

The load applied to the bank by the victim's loader and the supported section of pipeline caused the failure. This load caused the loose, hydraulically-placed sand to consolidate, extending into the shallow zone of saturated sand. The maneuvering of the loader likely created a zone of excess pressure that resulted in a loss of shear strength, causing the bank to fail under the sustained load.

Front-End Loader and Pipeline

The front-end loader involved in the accident was a Komatsu, Model WA500-3L approximately 13 feet high, 30 feet long, and 10 feet wide, with a wheelbase approximately 13 feet long. The contact area per tire was approximately four square feet. The weight of the loader was approximately 66,000 pounds.

The section of pipe being transported by the loader was an 80-foot long segment of 18-inch diameter, 3/8-inch thick steel pipe. It was fitted with four, 20-foot long, 38-inch diameter hollow steel pontoons. The weight of the pipe segment and pontoons was approximately 14,000 pounds.

The load applied to the sand bank by the victim's loader was equal to weight of the loader plus the weight of the pipe it supported. Considering that the loader was likely to be supporting half of the weight of the pipe section or 7,000 pounds, the total load applied to the bank by the victim's loader and supported pipeline section was approximately 73,000 pounds. The average applied load per tire was approximately 18,250 pounds and the average applied stress was approximately 4,500 pounds per square foot.

Weather

The weather on the day of the accident was clear, hot, and dry and was not considered a factor in the accident.

Personal Protective Equipment

Although a life-jacket was provided in the cab of the loader, the victim was not wearing one when recovered.

Training

Kent L. Raikes had 19 years, 4 months mining experience and had received training in accordance with 30 CFR, Part 46.

Steve Boothe had 20 years mining experience and had received training in accordance with 30 CFR, Part 46.

ROOT CAUSE ANALYSIS

A root cause analysis was conducted and the following root cause was identified:

Root Cause: The procedures failed to adequately address the risks associated with work performed near the dredge pond. Mining methods did not ensure that the stability of material could be maintained where persons worked or traveled near the dredge pond. The weight of the loader and dredge pipe exceeded the bank's ability to support it.

Corrective Action: Procedures should be established to ensure that persons can work safely near the dredge pond. The stability of tailing deposits should be determined before persons travel or work in these areas. These procedures should be posted and discussed with all persons working at the dredge pond.

CONCLUSION

The accident occurred because the procedures failed to adequately address the risks associated with work performed near the dredge pond. The mining methods used did not ensure that slope stability could be maintained in places where persons worked or traveled near the dredge pond. The waste sand shear strength of the dredge pond was incapable of maintaining a stable slope with the added dynamic of the front-end loader and the dredge pipe.

ENFORCEMENT ACTIONS

Order No. 6326800 was issued on July 18, 2007, under the provisions of Section 103(k) of the Mine Act:

A fatal accident occurred at this operation on July 18, 2007, when a miner operating a Komatsu WA500 front-end loader backed into the dredge pond. This order is issued to ensure the safety of all persons at this operation. It prohibits all activity at the dredge pond until MSHA has determined that it is safe to resume normal mining operations in the area. The mine operator shall obtain prior approval from the Authorized Representative for all actions to recover and/or restore operations at the affected area.

This order was terminated on July 21, 2007. Conditions that contributed to the accident no longer exist and normal mining operations can resume.

Citation No. 6326802 was issued on July 27, 2007, under the provisions of Section 104(a) of the Mine Act for violation of 30 CFR 56.3130:

On July 18, 2007, a fatal accident occurred at this mine when a front-end loader became submerged in a dredge pond. The victim had positioned a section of pipe on a bank of hydraulically placed sand when the material failed. The mine operator failed

to use mining methods that would maintain bank and slope stability in places where persons work or travel while performing their assigned tasks.

This citation was terminated on August 7, 2007. The mine operator established and implemented procedures to determine the stability of tailings deposits at the dredge pond. The procedures have been posted and discussed with all persons working at the dredge pond.

Approved by,

Date: December 3, 2007

Richard Laufenberg
District Manger

APPENDICES

- A. Persons Participating in the Investigation
- B. Victim Data Sheet

APPENDIX A
Persons Participating in the Investigation

Lyman-Richey Sand & Gravel Company

Doug L. Harrison	general manager
Stanley E. Benke, Jr.	corporate safety director
Jack Blevins	plant supervisor
Roger Temperley	operations coordinator
Steve Boothe	loader operator

Law Office of Adele L. Abrams P.C.

Adele L. Abrams, Esq.	counsel to operator
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Mine Safety and Health Administration

Shane P. Julien	mine safety and health inspector
Christopher J. Kelly	civil engineer

APPENDIX B

Victim Data Sheet

Accident Investigation Data - Victim Information

U.S. Department of Labor
Mine Safety and Health Administration



Event Number: 1 0 9 3 6 6 4

Victim Information: 1

1. Name of Injured/Ill Employee: <i>Kent L. Raikes</i>		2. Sex <i>M</i>	3. Victim's Age <i>42</i>	4. Last Four Digits of SSN:	5. Degree of Injury: <i>01 Fatal</i>										
6. Date(MM/DD/YY) and Time(24 Hr.) Of Death: <i>a. Date: 07/18/2007 b. Time: 12:55</i>				7. Date and Time Started: <i>a. Date: 07/18/2007 b. Time: 12:52</i>											
8. Regular Job Title: <i>182 Front end loader operator</i>		9. Work Activity when Injured: <i>053 Operating Komatsu WA500-3 FEL</i>			10. Was this work activity part of regular job? <div style="text-align: center;">Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></div>										
11. Experience a. This	Years	Weeks	Days	b. Regular	Years	Weeks	Days	c. This	Years	Weeks	Days	d. Total	Years	Weeks	Days
Work Activity:	<i>17</i>	<i>0</i>	<i>0</i>	Job Title:	<i>17</i>	<i>0</i>	<i>0</i>	Mine:	<i>10</i>	<i>0</i>	<i>0</i>	Mining:	<i>19</i>	<i>10</i>	<i>0</i>
12. What Directly Inflicted Injury or Illness? <i>126 Loader cab filling with water</i>				13. Nature of Injury or Illness: <i>110 Drowning</i>											
14. Training Deficiencies: Hazard: <input type="checkbox"/> New/Newly-Employed Experienced Miner: <input type="checkbox"/> Annual: <input type="checkbox"/> Task: <input type="checkbox"/>															
15. Company of Employment: (If different from production operator) <i>Operator</i>															
16. On-site Emergency Medical Treatment: Not Applicable: <input type="checkbox"/> First-Aid: <input type="checkbox"/> CPR: <input checked="" type="checkbox"/> EMT: <input checked="" type="checkbox"/> Medical Professional: <input type="checkbox"/> None: <input type="checkbox"/>															
17. Part 50 Document Control Number: (form 7000-1)				18. Union Affiliation of Victim: <i>9999 None (No Union Affiliation)</i>											